Zemea® Liquid Laundry Detergent Performance
(Prepared and Evaluated by an Independent Consumer Product Testing Facility)

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>WT, %</th>
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</thead>
<tbody>
<tr>
<td>C12-C13 Linear Alcohol EO-7</td>
<td>4.0%</td>
</tr>
<tr>
<td>Linear Dodecyl Benzene Sulfonate (60%)</td>
<td>14.0%</td>
</tr>
<tr>
<td>Sodium Laureth Sulfate (60%)</td>
<td>5.0%</td>
</tr>
<tr>
<td>Sodium Citrate</td>
<td>4.0%</td>
</tr>
<tr>
<td>Sodium Borate</td>
<td>4.0%</td>
</tr>
<tr>
<td><strong>Zemea® Propanediol</strong></td>
<td><strong>3.0%</strong></td>
</tr>
<tr>
<td>Tinopal CBS-X</td>
<td>0.1%</td>
</tr>
<tr>
<td>Protease</td>
<td>0.7%</td>
</tr>
<tr>
<td>Amylase</td>
<td>0.2%</td>
</tr>
<tr>
<td>Monethanolamine</td>
<td>0.5%</td>
</tr>
<tr>
<td>Coconut Fatty Acid (C12-C18)</td>
<td>2.0%</td>
</tr>
<tr>
<td>Water</td>
<td>62.5%</td>
</tr>
</tbody>
</table>

**SOILED & STAINED CLOTHS**

- Dust / Sebum
- Clay
- Coffee
- Cosmetic Make-up
- Grape Juice
- Grass
- Ink
- Spaghetti Sauce
- Motor Oil
- Cocoa
- Blood / Milk / Ink

**Physical Properties**

- pH, as is: 8.5
- Soluble Solids, 5 by refractometer: 29.3
- Residue on Drying, % by wt.: 28
- Viscosity, cPs @ 25°C: 194
- Visual Viscosity: Water Thin Pass
- Freeze/Thaw Stability (-15°/25°C): Pass
- Heat Stability (50°C), 30 days: Pass

**Performance Evaluation**

Soil and stain removal of a Zemea® propanediol detergent formulation and a similar propylene glycol detergent formulation were tested using cotton and cotton/polyester swatches. The standard soiled swatches were laundered under computer controlled laboratory test conditions. The swatches were read before and after laundering using a Hunter Colorimeter to calculate cleaning efficacy (% soil removal).

**Conclusion**

- Zemea® Propanediol can be successfully substituted for glycols in a laundry detergent formulation.
- Zemea® Propanediol formulations demonstrated comparable physical and performance (including soil and stain removal) properties.
- Zemea® Propanediol formulations were stable to freeze/thaw and elevated temperature (50°C) storage.

For additional information or samples, please contact:
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